FemtoampSense Operation Manual

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Things you need to prepare:

- 1) A stable platform to hold the instrument
- 2) A Faraday cage-at least 55cm x 40 cm x 25cm. An aluminum foil covered cardboard box can be used as the Faraday cage.
- 3) A stable power supplier with three outputs: +15-18V, -15-18V and ground. (Or four 9V batteries, if the positive output is below 15V, batteries must be changed.)
- 4) A computer/laptop with Windows 10 operation system.

To Begin With:

- 1) Install the operation software
- 2) Connect the instrument and the computer with a cable
- 3) Turn the instrument main power switch to "off", plug the three outputs of the power supplier to its corresponding position then turn the main power switch to "on".
- 4) Connect all three electrodes in an electrochemical cell,
- 5) Choose appropriate sensitivity by turning the rotary switch to the right position
- 6) Push the "reset" button on the rear panel until you hear a click, you will see the red light is on, wait for about 1 minute, then push the "reset" button one more time so that the red light is off.
- 7) Cover the entire instrument and your electrochemical cell in the Faraday cage
- 8) Open the instrument operation software, click the I/O box on the upper left-hand corner, choose com port that is connected to the instrument.

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VISA resource name	
COM6	1.8E-12-
Chronoamperometry	1.6E-12-
Stripping Cyclic Voltammetry	1.4E-12-
Stripping Differential Pulse Voltammetry	1.2E-12-
Differential Pulse Voltammetry	15.12
Normal Pulse Voltammetry	1E-12-
Cyclic Voltammetry	8E-13-
Initial Potential (V)	6E-13-
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9) Choose techniques

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10) Click the arrow so that it turns to black

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Differential Pulse Voltammetry	1.22-12-	Differential Pulse Voltammetry	15.12-
Normal Pulse Voltammetry	12-12-	Normal Pulse Voltammetry	12-12-
Cyclic Voltammetry	8E-13-	Cyclic Voltammetry	8E-13-

11) input parameters, then, click "ok" to confirm the parameters or click "cancel" to re-input



* If you want stop while the program is running, you can click "Stop" to stop the program, then, follow the procedure for "daily routine user" for your next run

* If there is a current overflow, you must immediately click the "Stop" button to stop the program, then, switch to lower sensitivity, then, push the "reset" button on the rear panel until you hear a click, you will see the red light is on, wait for about 1 minutes, then push the "reset" button one more time so that the red light is off. Follow the procedure for "daily routine user" for your next run

For daily routine uses:

1) Open the instrument operation software, click the I/O box on the up left corner, choose com port that is connected to the instrument.

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Differential Pulse Voltammetry	45.42
Normal Pulse Voltammetry	1E-12-
Cyclic Voltammetry	8E-13-
Initial Potential (V)	6E-13-
A) 0	4E-13-
Low Potential (V)	4

- 2) Connect all three electrodes in an electrochemical cell,
- 3) Choose appropriate sensitivity by turning the rotary switch to the right position
- Push the "reset" button on the rear panel until you hear a click, you will see the red light is on, wait for about 1 minute, then push the "reset" button one more time so that the red light is off.
- 5) Cover the entire instrument and your electrochemical cell in the Faraday cage
- 6) If the arrow on the up left corner is black, click the red button to turn it into white

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cyclic volumnetty	cycle voluminetty				Cyclic Voltammetry			



7) Choose a technique and Click the white arrow so that it turns blac

8) input parameters, then, click "ok" to confirm the parameters or click "cancel" to re-input parameters



9) Click "run" to run the program

* If you want stop while the program is running, you can click "Stop" to stop the program, then, follow the procedure for "daily routine user" for your next run

* If there is a current overflow, you must instantly click the "Stop" button to stop the program, then, switch to lower sensitivity, then, push the "reset" button on the rear panel until you hear a click, you will see the red light is on, wait for about 1 minute, then push the "reset" button one more time so that the red light is off. Follow the procedure for "daily routine user" for your next run.

Cyclic Voltammetry

Initial potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Low potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V. The low potential must be lower than the high potential

<u>High potential</u>: any potential between -2.5V and 2.5V, increment or decrement 0.001V. but the high potential must be higher than the low potential

Final potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Scan rate: any value between 0.0005V/s to 1.0 V/s, increment 0.0005V/s

Segment: any value between 1 and 100, increment or decrement 1.

Waiting time: any value between 1 and 100, increment or decrement 1.



Figure 1 potential excitation wave in Cyclic Voltammetry. E₀: initial potential; t0: waiting time; E_{high}: high potential; E_{low}: low potential; E_{final}: final potential;

Chronoamperometry

Initial potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Initial Time: integer number between 1 and 255 increment 1.

Potential Step 1: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Potential Step 1 Time: integer number between 1 and 255 increment 1.

Potential Step 2: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Potential Step 2 Time: integer number between 1 and 255 increment 1.

<u>Final Potential:</u> any potential between -2.5V and 2.5V, increment or decrement 0.001V.



Figure 2 potential excitation wave in Chronoamperometry. E0: initial potential; E1: potential step 1; E2: potential step 2; t0: initial time; t1: potential step 1 time; t2: potential step 2 time.

t (s)

Differential Pulse Voltammetry

Initial E: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Final E: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Step E: any value between 0.001 V and 0.100 V, increment 0.001V

Pulse Height: any value between 0.001 V and 0.200 V, increment 0.001V

Pulse Width: 50ms, unchangeable

Pulse Interval: 100ms, unchangeable



Figure 3 potential excitation wave in Differential Pulse Voltammetry. E_{ini}: initial E; E_{fianl}: final E; E_{step}: step E; E_{pulse}: pulse height; t_{interval}: pulse interval; t_{pulse}: pulse width;

Normal Pulse Voltammetry

Initial Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Final Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Pulse Magnitude: any potential between 0.001 V and 0.100 V, increment 0.001V.

Pulse Width: 50ms, unchangeable

Pulse Interval: 100ms, unchangeable



Figure 4 potential excitation wave in Normal Pulse Voltammetry. E_{ini}: initial E; E_{fiani}: final E; E_{magnitude}: pulse magnitude; t_{interval}: pulse interval; t_{pulse}: pulse width;

Striping Differential Pulse Voltammetry

Deposition Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Final Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Step E: any potential between 0.001 V and 0.100 V, increment 0.001V.

Pulse Height: any value between 0.001 V and 0.200 V, increment 0.001V

Pulse Width: 50ms, unchangeable

Pulse Interval: 100ms, unchangeable

Deposition Time: integer number between 1 and 100 increment 1.



t (s)

Figure 5 potential excitation wave in Stripping Differential Pulse Voltammetry. E_{ini}: deposition potential; E_{fianl}: final potential; E_{step}: step E; E_{pulse}: pulse height; t_{interval}: pulse interval; t_{pulse}: pulse width; t₀: deposition time

Striping Linear Scan Voltammetry

Deposition Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Final Potential: any potential between -2.5V and 2.5V, increment or decrement 0.001V.

Scan Rate: any value between 0.0005V/s to 1.0 V/s, increment 0.0005V/s

Deposition Time: integer number between 1 and 100 increment 1.



Figure 6 potential excitation wave in Stripping Linear Scan Voltammetry. $E_{deposition}$: deposition potential; E_{fianl} : final potential; t_0 : deposition time